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(54) Title: ADJUSTABLE LINEAR SUBSTRATE INFUSION

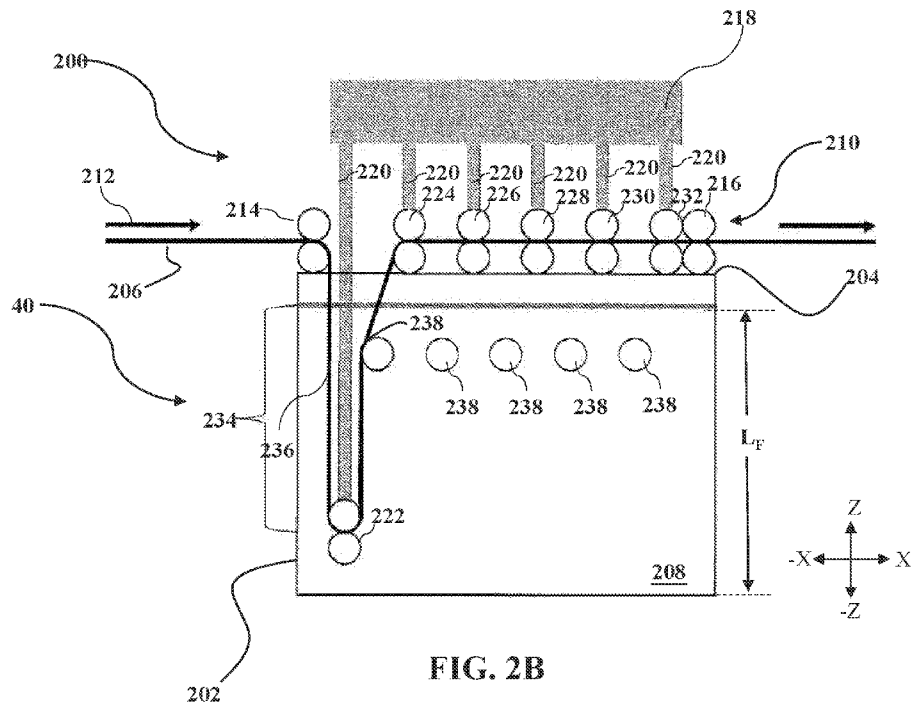


FIG. 2B

(57) Abstract: A method of forming an active agent infused linear material comprises flowing a liquid infusion solution comprising one or more active molecules into an infusion tank such that the liquid infusion solution fills the infusion tank to a fluid level, conveying a linear substrate in a first direction using a one or more linear substrate guides such that the linear substrate extends over the liquid infusion solution, and moving at least one of the one or more linear substrate guides in a second direction into the liquid infusion solution such that the linear substrate is immersed in the liquid infusion solution while the liquid infusion solution is at an infusion temperature to infuse the one or more active molecules into or onto a surface of the linear substrate thereby forming an active agent infused linear material.



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Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER
 IPC - D06B 23/22; D06P 3/24; D06B 3/00 (2022.01)
 CPC - D06B 23/22; D06P 3/241; D06B 3/00; D06B 5/02; D06P 3/00; D06B 3/02; D06P 3/24; D10B 2331/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2020/0340178 A1 (RADCO INFUSION TECHNOLOGIES, LLC) 29 October 2020; abstract; paragraphs [0025], [0051], [0054], [0067], [0075], [0077-0078], [0094-0099], [0107-0108]	1-32
Y	US 2019/0176365 A1 (BASF SE) 13 June 2019; figures 2-4; paragraphs [0050-0051], [0053], [0056-0057]; annotated figure 4	1-32
Y	CN 202388921 U (BEIJING YUNCHENG PRINTING MECHANICAL MAKING CO LTD) 22 August 2012; see machine translation; entire document	15
Y	CN 204023033 U (XIANGSHAN KANGLI KNITTING MILL) 17 December 2014; figure 1; see machine translation; entire document	17-18
Y	JP 2001062286 A (KEIO GIJUKU) 13 March 2001; figure 5; see machine translation; entire document	19-23
Y	US 2015/0096682 A1 (TOKYO ELECTRON LIMITED) 09 April 2015; figure 2; paragraph [0067]	22-23
Y	CN 211498158 U (TONGXIANG DONGQI FIBER ARRANGEMENT CO LTD) 15 September 2020; figures 1-2; see machine translation; entire document	31-32

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"D" document cited by the applicant in the international application	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"E" earlier application or patent but published on or after the international filing date	"&" document member of the same patent family
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 13 June 2022 (13.06.2022)	Date of mailing of the international search report JUL 12 2022
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Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas Telephone No. PCT Helpdesk: 571-272-4300
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US22/19121

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
 -Please See Supplemental Page-

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
Group I: Claims 1-32

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.:

PCT/US22/19121

.-***-Continued From Box No. III: Observations where unity of invention is lacking-***-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-32 are directed toward a method of forming an active agent infused linear material comprising: conveying a linear substrate in a first direction using one or more linear substrate guides such that the linear substrate extends over a liquid infusion solution; and moving the linear substrate in a second direction into the liquid infusion solution using at least one of the one or more linear substrate guides such that the linear substrate is immersed in the liquid infusion solution.

Group II: Claims 33-45 are directed toward a method of forming an active agent infused linear material comprising: manipulating the one or more linear substrate guides to immerse the linear substrate into a second liquid infusion solution in a second infusion tank heated to a second infusion temperature to infuse a second set of active molecules into or onto the surface of the linear substrate.

Group III: Claims 46-60 are directed toward a linear substrate infusion system comprising: an immersion unit disposed in alignment with the open side, the immersion unit comprising one or more movable linear substrate guides attached to the immersion unit via one or more linear substrate guide supports such that the one or more movable linear substrate guides are independently movable.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Group I include a method of forming an active agent infused linear material comprising: conveying a linear substrate in a first direction using one or more linear substrate guides such that the linear substrate extends over a liquid infusion solution; and moving the linear substrate in a second direction into the liquid infusion solution using at least one of the one or more linear substrate guides such that the linear substrate is immersed in the liquid infusion solution (which are not present in Groups II-III) while the liquid infusion solution is at an infusion temperature to infuse the one or more active molecules into or onto a surface of the linear substrate thereby forming an active agent infused linear material (which are not present in Group III).

Group II include a method of forming an active agent infused linear material comprising: manipulating one or more linear substrate guides to immerse a linear substrate into a first infusion tank containing a first liquid infusion solution heated to a first infusion temperature to infuse a first set of active molecules into or onto a surface of the linear substrate; moving at least one of the first infusion tank or the one or more linear substrate guides; and manipulating the one or more linear substrate guides to immerse the linear substrate into a second liquid infusion solution in a second infusion tank heated to a second infusion temperature to infuse a second set of active molecules into or onto the surface of the linear substrate (which are not present in Groups I and III).

Group III include a linear substrate infusion system comprising: a first infusion tank comprising an open side for receiving a linear substrate; and an immersion unit disposed in alignment with the open side, the immersion unit comprising one or more movable linear substrate guides attached to the immersion unit via one or more linear substrate guide supports such that the one or more movable linear substrate guides are independently movable towards the open end to be selectively inserted into the first infusion tank and removed from the first infusion tank (which are not present in Groups I-II).

The common technical features of Groups I-III are conveying/manipulating/moving a linear substrate using one or more linear substrate guides into a liquid infusion solution in a first infusion tank such that the linear substrate is immersed in the liquid infusion solution.

The common technical features of Groups I-II are immersing the linear substrate in the liquid infusion solution while the liquid infusion solution is at an infusion temperature to infuse the one or more active molecules into or onto a surface of the linear substrate thereby forming an active agent infused linear material.

The common technical features of Groups I-III are disclosed by US 9,718,080 B1 (RADCO). Radco discloses conveying/manipulating/moving a linear substrate using one or more linear substrate guides into a liquid infusion solution in a first infusion tank such that the linear substrate is immersed in the liquid infusion solution (the linear substrate is fed by a spool or extruder (linear substrate guide) into the infusion compartment 40 (first infusion tank) to be immersed in the coloring dye solution (liquid infusion solution); column 6, lines 15-30; column 12, line 50 – column 13, line 25).

The common technical features of Groups I-II are disclosed by Radco. Radco discloses immersing the linear substrate in the liquid infusion solution while the liquid infusion solution is at an infusion temperature to infuse the one or more active molecules into or onto a surface of the linear substrate thereby forming an active agent infused linear material (the linear substrate is fed by a spool or extruder (linear substrate guide) into the infusion compartment 40 (first infusion tank) to be immersed in the heated (infusion temperature) for infusion of active molecules; column 5, lines 45-55; column 6, lines 1-30; column 12, line 50 – column 13, line 25).

Since the common technical features are previously disclosed by the Radco reference, the common features are not special and so Groups I-III lack unity.